El Alumbre: Design, Implementation and Management of a Community Small-scale Wind Generation Project

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International Workshop on SMALL WIND ENERGY FOR DEVELOPING COUNTRIES Reliability, Materials and Case Studies
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Outline

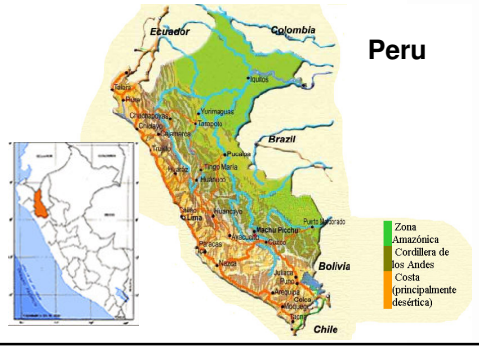
1. Introduction
2. Objectives
3. Technical description
4. Management model
5. Results and conclusions

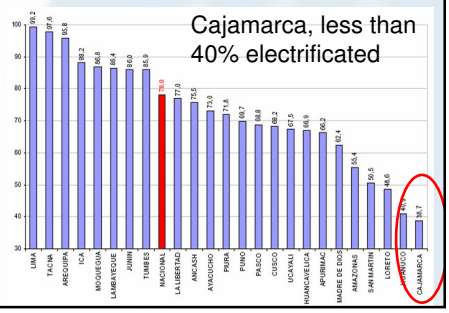
Introduction

- Decentralized Electrification systems that use renewable energy have proven suitable for providing electricity to isolated communities.
  - Use local resource, avoid external dependences
  - Cheaper than grid extension
- Wind power is one of the technical options available, although infrequently used to date.
  - Micro hydro systems are proportionally cheaper and produce more and better energy
  - Solar systems may be easier to design
- Micro wind systems have recently been used in electrification projects in Cajamarca, a mountainous area in the North of Peru.

Objectives

- To describe the aspects of technical design, implementation and management of the first small-scale community wind generation project for rural electrification in Peru (region of Cajamarca).
  - The project was implemented by the NGOs Soluciones Prácticas – ITDG (Peru) and Engineers without Borders (Cataluña, Spain)
  - Period: June 07 – February 09





Objectives

- This project took place in the community of El Alumbre:
  - It is located in the Northern mountains of Peru at 3850 m of altitude.
  - It is characterized by low to medium wind resource.
  - It has 33 families (151 inhabitants) who are mainly engaged in subsistence agriculture and livestock rearing.



Technical Description

- The electrification project is designed to cover basic household needs and community services (school and health center).
  - First phase:
    - 21 wind turbines (100W) were installed at homes
    - 1 wind turbine of 500W was installed at the school.
  - Second phase:
    - 14 family systems (100W) and 100 a 500W turbine at the health center.
    - Following the wind potential evaluation, in the points with lower wind resource, the wind turbines were installed on higher towers and redesigned tails.

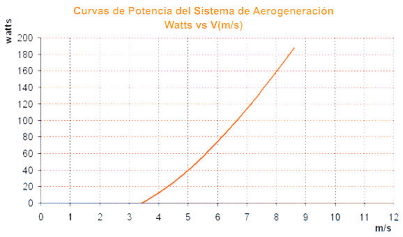


Technical Description

- Wind turbines:
  - Models developed by ITDG:
    - Prioritizes robustness and ease of maintenance
    - Low-moderate wind speeds, furling tale, permanent-magnets generators

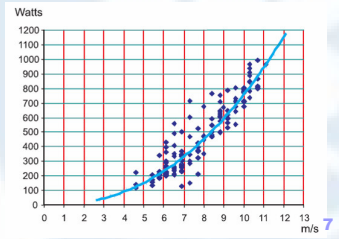
- IT-PE-100

Power: 100W at 6,5m/s
Wind speed: 2,5m/s -12m/s
Towel: 7m-10m, diameter:1,7m



- SP-500

Power: 500W at 8m/s
Wind speed: 3m/s -12m/s
Tower: 10m-15m, diameter:4m



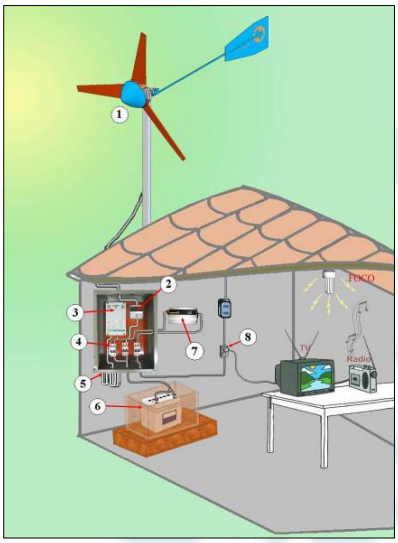
Technical Description

- Wind turbines
  - Manufactured by local companies, thereby stimulating business creation and facilitating repair and parts replacement

Technical Description

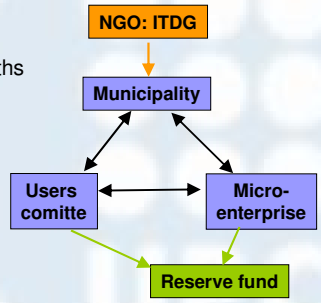
- Equipment installed:
  - Regulator, a battery bank, resistance, an inverter to facilitate the purchase and use of AC equipment.

Equipment	USD
Wind turbine 100 W	600
Battery 130 AH	180
Regulator 35 A	160
Inverter 12 VDC/220VAC- 300 W	140
Circuit breaker	40
Wires	75
Accessories	35
Resistance 200 W	30
TOTAL	1260



Management model

- Management model structure: local micro-enterprise
  - Micro-enterprise
    - Run by one operator-administrator from the community
    - Formed to operate, maintain and administer all of the systems.
    - It is legally registered as a sole proprietorship and has register of users
    - Has a tariff structure: each family pays 9 soles/month ($3/month)
  - Users committee
    - Board/assembly of users
    - Financial oversight meetings every 3 months
  - Reserve fund
    - Pays the operator/administrator
    - Replacements: batteries, etc.
    - Bank account with 3 signatures
  - Municipality
    - Owner of the systems
  - NGO ITDG
    - Supervision, training and back-up technical support



Management model

- Selection of the operator-administrator
  - The community itself selected 8 candidates
  - All of the candidates participated in a comprehensive training program which covered both administrative and technical skills.
  - The project team and community leaders selected the top candidate based on evaluations during the training program as well as past community involvement.

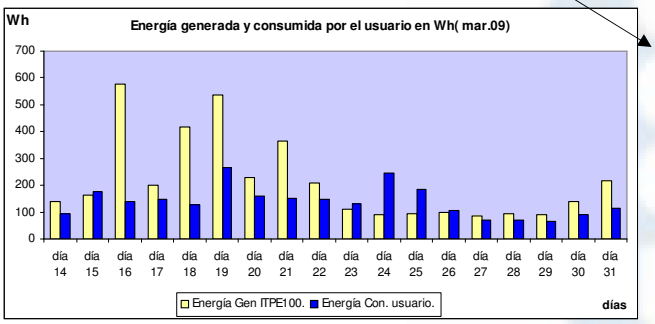


Management model

- Training users
  - Topics/Skills:
    - Technical: how to operate the household equipment
    - Management/Administration: understand the rights and duties
  - Organization:
    - Theoretical lessons at school
    - Practice during the systems installation


Results and conclusions

- Evaluation
  - Interviews and focus groups
  - Monitoring equipments
    - Individual data loggers
    - Generated/consumed energy



Results and conclusions

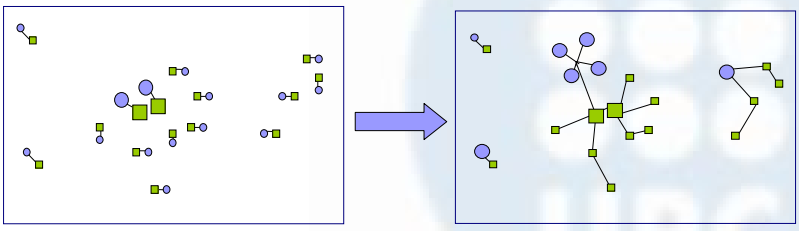
- Domestic use: around 5 hours/day of electricity.
  - 100% use the system for lighting (studying), 57% are now weaving or knitting in the evening, 43% have radios, 93% are charging cell phones.
  - 70% families are expressing a reduction in expenditures in other energy sources such as kerosene or candles.
- School:
  - Four computers (with digital encyclopedias) and a DVD
  - Used by 80 students from El Alumbre and neighboring communities
- Health center: Now has electricity for lights and a vaccine refrigerator

Results and conclusions

- The Alumbre micro-enterprise for rural electrical services has been successfully operating for over a year.
- The introduction of concepts of customer service in the structure of a single person micro-enterprise is an innovative way of promoting sustainability.
- Families have been using energy in a direct or indirect way in the implementation of small business such as fabrication of cheese, production of sweaters, charge of batteries and cellular phones or a radio station.

Results and conclusions

- Limitations
  - The shortage of wind resource at some points may restrict the electricity
  - consumption of some families
  - The use of more powerful wind generators is not considered
- Future projects/works
  - A design solution that considers both individual generators and micro grids, taking into account the detailed wind resource map.



Thank you very much for your attention

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